Volume 27 Study T-3

STATE OF ALASKA

Bill Sheffield, Governor

Annual Performance Report for ANCHORAGE URBAN TROUT STUDIES

by

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RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish Investigations of Alaska

Project: F-9-18

Study: T-3 Study Title: COOK INLET TROUT

Job: T-3-1 Job Title: Anchorage Urban Trout Studies

Cooperators: Kelly R. Hepler and Christopher F. Bowden

Period Covered: July 1, 1985 to June 30, 1986

ABSTRACT

This research project was initiated in 1985 to provide information to develop stocking strategies that would provide a diverse angling experience while maintaining acceptable harvest rates for the Anchorage urban area.

Survival estimates for rainbow trout, *Salmo gairdneri* Richardson, stocked as catchables in three Anchorage area lakes, ranged from 14 percent to 31 percent after 3 months residency. The survival estimates for chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), stocked as smolts at 300 per surface acre in Campbell Point Lake was 29 percent 3 months later.

The mean weight measurements collected in the fall of 1985 indicated that rainbow trout and chinook salmon increased 73 percent and 165 percent, respectively, from the initial mean stocking weights in June. Final sampling results indicate that gill nets were more selective for larger fish than fyke nets.

A total of 35,000 steelhead smolts were released in Campbell Creek in June 1985. The outmigration was monitored through the use of a Canadian fan-trap. The swimming strength of the juvenile steelhead allowed them to avoid the trap.

During July 1985, 1,000 catchable size rainbow trout were released into Campbell Creek between barrier weirs. Population estimates, resulting from mark-and-recapture sampling, ranged from 353 to 668.

Dissolved oxygen measurements were collected in March 1985 in 20 Anchorage area lakes. Lower Fire and Taku/Campbell Lakes had 2.8 parts per million at the 10-foot depth. Subsequent net sampling in both lakes in June indicated the fish survived.

Volumetric surveys were conducted on Campbell Point, Delong, Jewel and Sand Lakes. Bathymetric charts were prepared for each of the four study lakes.

KEY WORDS

Southcentral Alaska, rainbow trout, steelhead smolts, landlocked chinook salmon, fish stocking, blackfish, population estimates, fish growth.

BACKGROUND

Satisfying growing public demand for diversified recreational fishing opportunities while simultaneously maintaining and protecting fishery resources is the responsibility of the Alaska Department of Fish and Game. Many accessible fisheries within the Cook Inlet area have become congested, and the angling pressure on Anchorage urban waters is increasing. The increasing demand for angling opportunities in the Anchorage area is illustrated by the Statewide Harvest Study, which indicates that fishing effort has increased 118% from the 55,060 angler-days expended in 1977 to the 119,972 angler days in 1984 (Mills 1985). Similarly, the harvest increased 136% during the same period.

The majority of fishing effort in the Anchorage area occurs in stocked lakes. These lakes have been stocked, primarily with rainbow trout, since statehood. The number of stocking locations has expanded from four in 1961 to 22 in 1985. Anchorage area waters have been stocked with eight different strains of rainbow trout in the last 25 years. Rainbow trout that were stocked prior to 1974 were primarily in the fingerling-smolt size range. Since 1974 the majority of rainbow trout stocked have been in the catchable size range (6-8 inches).

In addition to stocking lakes, the Department has also conducted a stocking program in Campbell Creek since 1983, although Campbell Creek was not stocked in 1985 because coliform bacteria counts indicated the water quality was undergoing serious degradation and certain inconsistencies were perceived in planting catchable size rainbow trout in the polluted creek. A great amount of publicity has centered on the Campbell Creek pollution, and the Municipality of Anchorage has set up numerous signs adjacent to the creek advising residents of that problem. The Municipality is lobbying the Legislature for monies to study the problem, and it is confident that the pollution problem can be eliminated.

The Department initiated a steelhead smolt release in Campbell Creek in 1985. This was an experimental release that was designed to expand the northern range of naturally occurring Cook Inlet steelhead stocks. The first adult steelhead are expected to return in the fall of 1986. The Department plans to utilize the returning steelhead for recreational angling and for a brood source for future enhancement efforts.

Since 1973 Sport Fish Division has been conducting research in select Matanuska-Susitna lakes to provide information for the development of

improved lake stocking practices (Havens 1985). This research was expanded in 1985 to include four lakes in Anchorage. It has been very difficult to develop multiyear age classes in these lakes, because by fall, intensive fishing effort and natural mortality have combined to delete 80-90% of the fish that were stocked in the spring.

This study was undertaken to determine stocked fish survival and growth in lakes of known limnological characteristics; one lake contained a predator species. The goal of the study is to provide the necessary information to develop stocking strategies that, in turn, will provide a diverse angling experience while maintaining acceptable harvest rates.

The Department has recently identified the need to expand our rainbow trout life history data base. In conjunction with this need, studies were undertaken in Campbell Creek to initiate the development of adequate sampling methodologies for assessing rainbow trout populations and comparing different population estimators.

Table 1 lists all species mentioned in this report. Figure 1 is a map showing the study area.

RECOMMENDATIONS

1. Growth and relative survival of 80-110 g rainbow trout should be determined in Jewel, Sand and Delong Lakes.

2. Growth and relative survival of 15-20 g chinook salmon should be determined in Delong and Campbell Point Lakes.

3. Growth and relative survival of Arctic grayling fingerlings should be determined in Lower Fire Lake.

4. Conduct volumetric surveys on Lower Fire, Mirror, Beach, Taku-Campbell and Cheney Lakes.

OBJECTIVES

1. Determine 1985 stocked rainbow trout growth and survival (population estimates) in Jewel, Delong and Campbell Point Lakes in September 1985 and May 1986.

2. Determine 1985 stocked chinook salmon growth and survival (population estimates) in Sand and Campbell Point Lakes in September 1985 and May 1986.

3. Conduct water quality sampling to obtain dissolved oxygen profiles, conductivity, pH, temperature, alkalinity and hardness measurements in 20 lakes in September 1985 and March 1986.

4. Conduct volumetric surveys to determine surface acres, mean and maximum depths, total volume, volume and surface

Table 1. List of Common Names, Scientific Names and Abbreviations.

Common Name	Scientific Name and Author	Abbreviation
Arctic grayling	*Thymallus arcticus* (Pallas)	GR
Alaska blackfish	*Dallia pectoralis* Bean	BF
Chinook salmon	*Oncorhynchus tshawytscha* (Walbaum)	KS
Rainbow trout	*Salmo Gairdneri* Richardson	RT

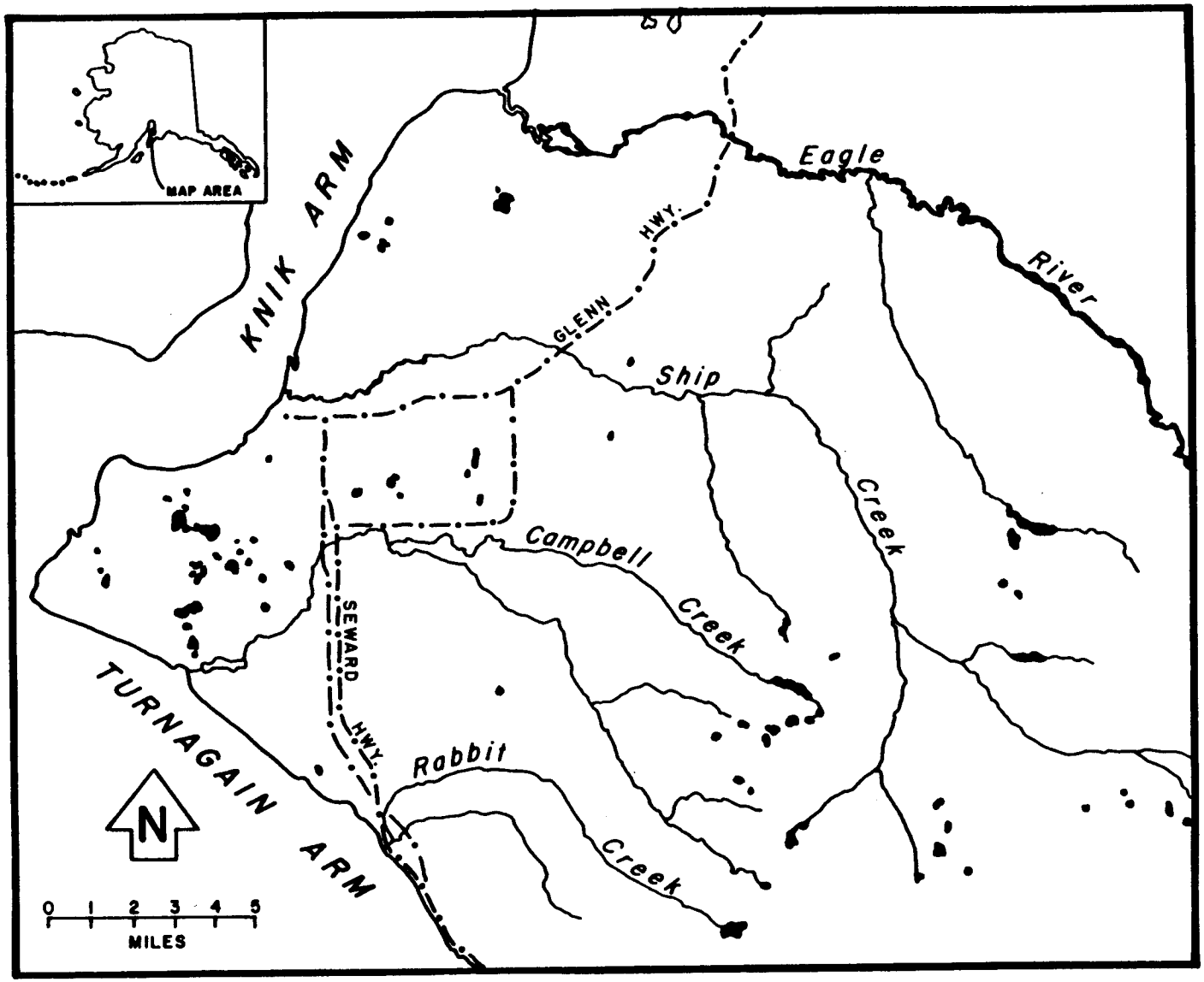

Figure 1. The Anchorage Urban Study Area.

area of littoral and lentic zones within 5 foot depth contours and shore length for Jewel, Sand, Delong and Campbell Point Lakes from July 1985 through June 1986.

5. Determine the steelhead smolt emigration from the Campbell Creek system after their initial release in May through June.

6. Initiate the development of adequate methodologies of assessing rainbow trout populations, including population estimates in Campbell Creek in July through October 1985.

TECHNIQUES USED

Lake Population Estimates

Rainbow trout survival estimates were conducted in Jewel, Delong and Sand Lakes, and those for chinook salmon were developed in Campbell Point and Delong Lakes. These estimates were determined by utilizing Schnabel's multiple-census estimator (Ricker 1975). Prior to stocking, population estimates were conducted on each of the four study lakes at the beginning of summer. Stocking densities were established at approximately 300 fish per surface acre for a single species, and on lakes where two different species were planted, each one (rainbow trout and chinook salmon) was stocked at 150 fish per surface acre.

Fyke nets, baited with salmon eggs, were utilized to capture both rainbow trout and chinook salmon for marking purposes. Fyke nets were 12 feet in length and had two external wings measuring 4 feet by 30 feet. Two 48-inch square aluminum frames supported the entrance, while the body of the fyke net was supported by four 40-inch diameter hoops. A 6-foot long cod end was attached to the trailing end of the fyke net to facilitate removal of the captured fish. The body, wings and internal throats were constructed of 3/16-inch square mesh, knotless nylon. Small cement anchors were attached to the leading edge of each wing and to the cod end to provide additional support to the fyke net.

When attempting to capture fish, each fyke net was positioned parallel to the shoreline. Nets were allowed to soak for approximately 24 hours prior to verifying capture results. When sampling each lake, four nets were utilized concurrently.

After capturing rainbow trout and chinook salmon for population estimates, the fish were confined in a tub of water, oxygenated with a portable 20-pound regulated oxygen bottle. Captured fish were then anesthetized with MS-222, at 0.25 grams of anesthetic per gallon of water. The total sample of fish was then enumerated and, in the spring sampling, each fish received an adipose finclip. In the fall sampling, each fish was marked with a cold-brand design on its right side between the lateral line and the dorsal fin. In addition to cold brands, every fish captured in the fall sampling also received a right pelvic finclip. The marking equipment consisted of a 3/8-inch brass rod inserted into a wooden dowel handle. The brass rod was tipped with a 1/4-inch raised

crescent emblem fabricated of silver. The rods were cooled by immersion into a slurry of dry ice and 100% ethanol kept in a styrofoam container. After cooling in the slurry, the marking rod was placed firmly and evenly on the side of the fish for about 2 seconds. After marking, each fish was weighed, measured and returned to the lake. Both rainbow trout and chinook salmon length measurements were expressed in fork lengths, to the nearest millimeter, and weight measurements were expressed to the nearest gram.

During the recapture phase of each population estimate, rainbow trout and chinook salmon were captured with fyke nets and gill nets. The recapture phase occurred 10 to 15 days after the fish were initially marked to allow the marked fish time to disperse and mix randomly throughout the lake. Gill nets measured 120 feet by 6 feet and were designed with variable mesh sizes. The gill nets consisted of six 20-foot panels, each with a different mesh size. Mesh sizes were 1/2-inch, 5/8-inch, 3/4-inch, 1-inch, 1 1/2-inch and 2-inch.

Water Quality Sampling

Water quality information was collected on 20 local lakes in the Anchorage area during the spring (under ice) and summer (open water). These lakes included Behm, Campbell, Campbell Point, Cheney, Clunie, Delong, Fish, Green, Gwen, Hillberg, Jewel, Lower Fire, Mirror, Otter, Sand, Six-mile, Spring, Taku-Campbell, Thompson and Triangle. Information pertaining to dissolved oxygen, temperature, pH, and specific conductivity was collected from each lake with a model-4041 Hydrolab and a 4041-11 sensor probe. On each lake a vertical profile for dissolved oxygen, temperature and pH was developed over its deepest part. Specific conductivity measurements were recorded from 1 meter below the ice (spring) or 1 meter below the water surface (summer).

Alkalinity and hardness levels were also monitored in each of the 20 urban lakes. A Kemmerer bottle was used to collect water samples 1 meter below the ice or water surface, depending on the season. Alkalinity and hardness levels were then determined with a Hach water-quality kit (model AL 36B).

Volumetrics

Bathymetric surveys were conducted on Campbell Point, Delong, Jewel and Sand Lakes. Scaled aerial photographs were used for developing base maps and for delineating specific transects. In the field, each transect was then evaluated by utilizing a recording fathometer (Lowrance model LRG-1510-B) to distinguish specific depth characteristics. Recorded information was then transcribed onto scaled base maps to identify depth contours at 5-foot intervals. After depth contours were established, surface measurements for each 5-foot interval, including the total lake perimeter, were digitized on a Calcomp-9000 digitizing table. Resulting information was calculated and provided through custom designed software on the DG MV 4000 computer to provide specific measurements for each lake's volumetric analysis. Each 5-foot contour was digitized three times and then averaged to provide the final perimeter measurement for each interval. The volume of water in the stratum

between two contour lines (Vs) was then estimated as :

$$Vs=h/3(A1 + A2 + \sqrt{A1+A2})$$

The total volume for each lake is the sum of the volumes for each stratum (Nielsen and Johnson 1983). Mean depth for each lake is calculated by dividing the total volume by the total surface area (Nielsen and Johnson 1983).

After water-quality and volumetric information was collected and assessed, a morphoedaphic index (MEI) was calculated by dividing specific conductivity by mean depth (Nielsen and Johnson 1983).

Campbell Creek Steelhead Smolt Emigration

In mid-June, 35,000 steelhead smolts were released into Campbell Creek 3 miles upstream from the outlet. The steelhead smolt emigration was monitored using a Canadian fan-trap to capture out-migrants. The trap was placed at the outlet of Campbell Lake, where a series of short falls and pools flow into the intertidal zone. The forward opening of the trap was located at the base of the first fall. The trap was constructed of angle aluminum, measuring 1.5 square meters at the forward opening and tapering to 0.3 square meter at the downstream passage; total length of the trap was 3 meters. The trap was covered with perforated synthetic sheeting. A holding pen was attached to the downstream opening of the trap by a camlock fitting. The holding pen was rectangular in shape and measured 1.5 x 0.9 x 0.6 meters. The front, back and bottom of the pen were constructed of 3/4-inch plywood and the remaining two sides of perforated aluminum plate. The holding pen was designed to float by attaching styrofoam floatation chambers to each side. The bottom was also vented to assist the continual circulation of water through the pen.

All fish captured by the fan-trap were enumerated by species and released. The trap was monitored during 24-hour intervals to determine diel changes in the rate of smolt emigration.

Sampling Methodologies for Campbell Creek Rainbow Trout

In mid-July 1,000 catchable size rainbow were released into the north fork of Campbell Creek. The fish were initially released between two weirs, 100 meters apart, that served as blocking nets within the selected site. The weirs were constructed of standard lumber and 1/2-inch mesh wire hardware cloth. After the fish acclimated to ambient water conditions (approximately 24 hours), the barriers were removed. Distribution and movement of the fish was monitored over the next 6 days. A Coefelt BP-1 backpack electroshocker was used to capture fish, identify upper and lower limits of distribution, and verify other characteristics of dispersal. Three sampling passes were conducted over the following 6 days. The initial pass was conducted on the day after the weir was removed, and subsequent sampling passes occurred on the third and sixth days. All captured rainbow trout were marked with a caudal punch. Population estimates were developed using a single census estimator

(Ricker 1975) and two multiple-census estimators (Seber and Lecren 1967): Chapman's modification of the Peterson estimator and the Schnabel and Two Pass Removal Methods, respectively.

FINDINGS

Population Estimates

Prior to stocking in June, population estimates were performed in Jewel, Delong, Sand and Campbell Point Lakes to determine initial population levels and survival of the 1984 plants (Table 2). In 1984 all four of the study lakes were stocked with catchable size rainbow trout, and Sand Lake was the only lake not stocked with rainbow trout brood stock. Because of insufficient fish numbers, we were only able to formulate population estimates on Jewel and Campbell Point Lakes. The initial population estimates indicate that Jewel and Campbell Point Lakes had 10% and 12% survivals, respectively (Table 2). The survival estimates, with 95% confidence, ranged from 8-14% for Jewel Lake to 8-21% for Campbell Point Lake. Prior to 1985, stocking densities varied from lake to lake and were qualitatively determined on the basis of harvest and effort for each respective lake. It is interesting to note that the two lakes containing sufficient fish numbers to calculate population estimates (Jewel and Campbell Point) also had the highest stocking densities.

Prior to initiation of stocking in 1985, several study-plan changes were necessary because of last minute problems encountered in attaining the necessary quantities and species of fish. It was originally intended to stock Sand Lake with chinook salmon and Campbell Point Lake with a one-to-one ratio of chinook salmon and rainbow trout. Severe shortages of chinook salmon resulted in significant alterations to the original study plan. Ultimately, Sand Lake was deleted from the chinook salmon stocking schedule; however, it received rainbow trout along with Jewel Lake. Campbell Lake was stocked only with chinook salmon, at 300 per surface acre, and Delong Lake was stocked at the same density with a combination of rainbow trout and chinook salmon.

Over-summer survival was determined by developing population estimates during September and October. Rainbow trout survivals ranged from a low of 14% in Delong Lake to a high of 31% in Sand Lake. The higher rainbow trout survival rate in Sand Lake can be partially attributed to severely restricted access because of predominately private land surrounding the perimeter. Campbell Point Lake as less restricted access than this and both Jewel and Delong Lakes have excellent angler access. Campbell Point had a 29% survival rate for chinook salmon, and in Delong Lake insufficient numbers of chinook salmon were captured to formulate a population estimate. The lower chinook salmon survival rate in Delong Lake may have been influenced by blackfish, either through predation or competition for food and/or habitat availability.

Mean-weight measurements collected in the fall on all four research lakes indicated that both rainbow trout and chinook salmon exhibited good gains from their initial release weight (Table 3). Mean-weight

Table 2. Population Estimates for Rainbow Trout and Chinook Salmon in Selected Anchorage Area Lakes, 1985.

Lake	Date Stocked	Species Stocked	Number Stocked	Stocking Size*	Stocking Density (fish/surface acre)	Sample Date	Population Estimate	Survival	95% Conficence Levels Estimate	95% Conficence Levels Survival
Jewel	5/18/84	RT	14,528	Catchable	555	5/23/85	1,535**	10%	1,207- 2,108	8- 14%
	7/11/84	RT	125	Brood	4.8	5/23/85	**	**	**	**
	6/21/85	RT	6,790	Catchable	260	9/04/85	1,324	16%	669-65,593	8- 788%
Sand	5/18/84	RT	7,204	Catchable	107	6/15/85	***	***	***	***
	6/25/85	RT	14,530	Catchable	216	9/06/85	4,575	31%	2,702-14,903	19- 103%
Delong	5/18/84	RT	5,260	Catchable	266	6/03/85	***	***	***	***
	7/13/84	RT	129	Brood	6.6	6/03/85	***	***	***	***
	6/20/85	RT	3,310	Catchable	168	9/14/85	456	14%	291- 1,051	9- 32%
	6/11/85	KS	3,000	Smolt	152	9/14/85	***	***	***	***
Campbell Pt.	5/21/84	RT	3,861	Catchable	446	5/29/85	467**	12%	324- 833	8- 21%
	7/18/84	RT	150	Brood	17	5/29/85	**		**	**
	6/11/85	KS	3,000	Smolt	347	9/12/85	865	29%	437-43,250	15-1,442%

* Stocking size: catchable = 50-80 g
brood = 2-3 kg
smolt = 17 g

** Population estimates are for both catchable and brood sized rainbow trout combined.

*** There was an insufficient number of tag recaptures to formulate a population estimate.

Table 3. Length-Weight Summaries for Rainbow Trout and Chinook Salmon in Selected Anchorage Area Lakes, 1985.

Lake	Species	Date Stocked	Number Stocked	Average Stocking Size (g)	Sample Date	Sample* Gear	Number Caught	Mean Length (mm)	Length Range (mm)	Mean Weight (g)	Weight Range (g)
Sand	RT	6/25/85	14,500	56	10/1/85	FN	188	211	118-310	96	33-298
						GN	64	233	172-372	141	35-600
								217	118-372	107	33-600
Campbell Pt.	KS	6/11/85	3,000	17	9/24/85	FN	61	156	132-175	42	19- 63
						GN	13	168	155-185	54	42- 80
								158	132-185	44	19- 80
Jewel	RT	6/21/85	6,800	56	9/20/85	FN	70	197	125-340	82	21-390
						GN	34	256	170-355	209	77-600
								216	125-355	124	21-600
Delong	RT	6/20/85	3,300	56	10/3/85	FN	58	197	155-305	83	32-325
						GN	19	223	167-267	121	50-219
								203	155-305	92	32-325
	KS	6/11/85	3,000	17	10/5/85	FN	6	170	165-175	53	46- 62

* FN = fyke net
GN = gill net

measurements for rainbow trout that had been stocked at an average weight of 56 g in June were 107, 124 and 92 g in Sand, Jewel and Delong Lakes, respectively. Rainbow trout growth in Delong Lake may have been adversely affected by the aforementioned blackfish population. Chinook salmon were initially stocked at an average weight of 17 g; this weight increased in Campbell Point and Delong Lakes to 44 and 53 g, respectively.

Gill nets were more selective towards larger fish than fyke nets in all four of the study lakes (Table 3). The mean weight of fish captured by gill nets ranged from 29-155% greater than fyke net catches, and the mean length was 8-30% greater.

It is important to recognize that this is the first year of the urban lake research program, and it is difficult to derive any definite conclusions from the data. Results from the 1985 research will be utilized to refine sampling techniques and research objectives and to form a comparative data base for future studies.

Campbell Creek Rainbow/Steelhead Trout Studies

Steelhead Smolt Emmigration:

A total of 35,000 steelhead smolts were released into Campbell Creek in mid-June. The out-migration was to be monitored and sampled at the outlet of Campbell Lake with a Canadian fan-trap; however, the swimming strength of juvenile steelhead allowed them to avoid the trap. A small number of steelhead were captured, and observations indicated that they could easily swim against the current to escape entrapment. The trap was repositioned several times in attempts to increase the water velocity through the trap; however, capture efficiency did not improve. If this exercise is to be conducted in the future, it is strongly recommended that the trap be redesigned or an appropriate juvenile trap substituted.

Rainbow Trout Population Studies:

The original study plan outlined the releasing of rainbow trout in two different reaches of Campbell Creek and the developing of a sampling methodology. This plan was modified after the aforementioned pollution problems were taken into consideration. We opted to stock only the north fork of Campbell Creek, an area closed to fishing, to minimize any possible interaction with the angling public. The original study plan also outlined the use of a picket weir, but the weir design was altered after consulting Division of Fisheries Rehabilitation, Enhancement and Development (F.R.E.D.) engineers.

During mid-July, 1,000 catchable size rainbow trout were released into the north fork of Campbell Creek between two barrier weirs. Because of the heavy rainfall that occurred prior to installing the weirs, the operation encountered certain difficulties. With high water conditions, debris and organic matter were carried from the banks into the water column. This resulted in a heavy load of waterborne materials accumulating on the wire-mesh panels of the weir. This heavy accumulation of

material required a 24-hour continual cleaning effort. Wire-mesh panels had to be cleaned at approximately 15-minute intervals so that the weir would not be jeopardized by a potential washout. Weirs of wire-mesh construction are not recommended for future operations in the Campbell Creek drainage.

The planted fish were allowed to acclimate to ambient water conditions for 24 hours and then the barrier weirs were removed. The population estimates (Table 4) ranged from a low of 353 fish (Two Pass Removal Method) to a high of 668 fish (Chapman's Method). It is difficult to identify the reasons why the population estimates were significantly lower than the known populations of stocked fish. It would have been beneficial to conduct additional population estimates over a greater time frame, but extensive equipment malfunctions associated with the electroshocking gear resulted in early curtailment of the operation.

Water Quality Sampling:

Prior to the 1985 season, only limited water-quality information was available for local urban lakes. Baseline water-quality measurements were collected during the spring and mid-summer of 1985 on 20 urban lakes. Dissolved oxygen measurements were collected during early spring to predict over-winter survival. Dissolved oxygen concentrations collected during March at 3 feet below the lake ice surface ranged from 2.6 ppm in Spring Lake to 11.3 ppm in Taku-Campbell Lake. Midwater samples collected at approximately the 10-foot depth ranged from 7.6 ppm in Sand Lake to 2.8 ppm in Lower Fire and Taku-Campbell Lakes. Havens (1984) found that fish survived in lakes with dissolved oxygen levels as low as 2.4 ppm, and subsequent sampling with nets in June indicated that fish stocked in Lower Fire and Taku-Campbell Lakes survived.

Volumetrics:

Volumetric surveys were conducted on Campbell Point, Delong, Jewel and Sand Lakes, and bathymetric charts were developed from the survey data (Figures 2-5).

Table 4. Campbell Creek Rainbow Trout Population Study, 1985.

Population Estimator	Population Estimate	95% Confidence Limit Lower	Upper
Chapman's Modification of Peterson Sample Day 1	668	563	832
Two Pass Removal Method	353	278	428
Schnabel	650	550	795

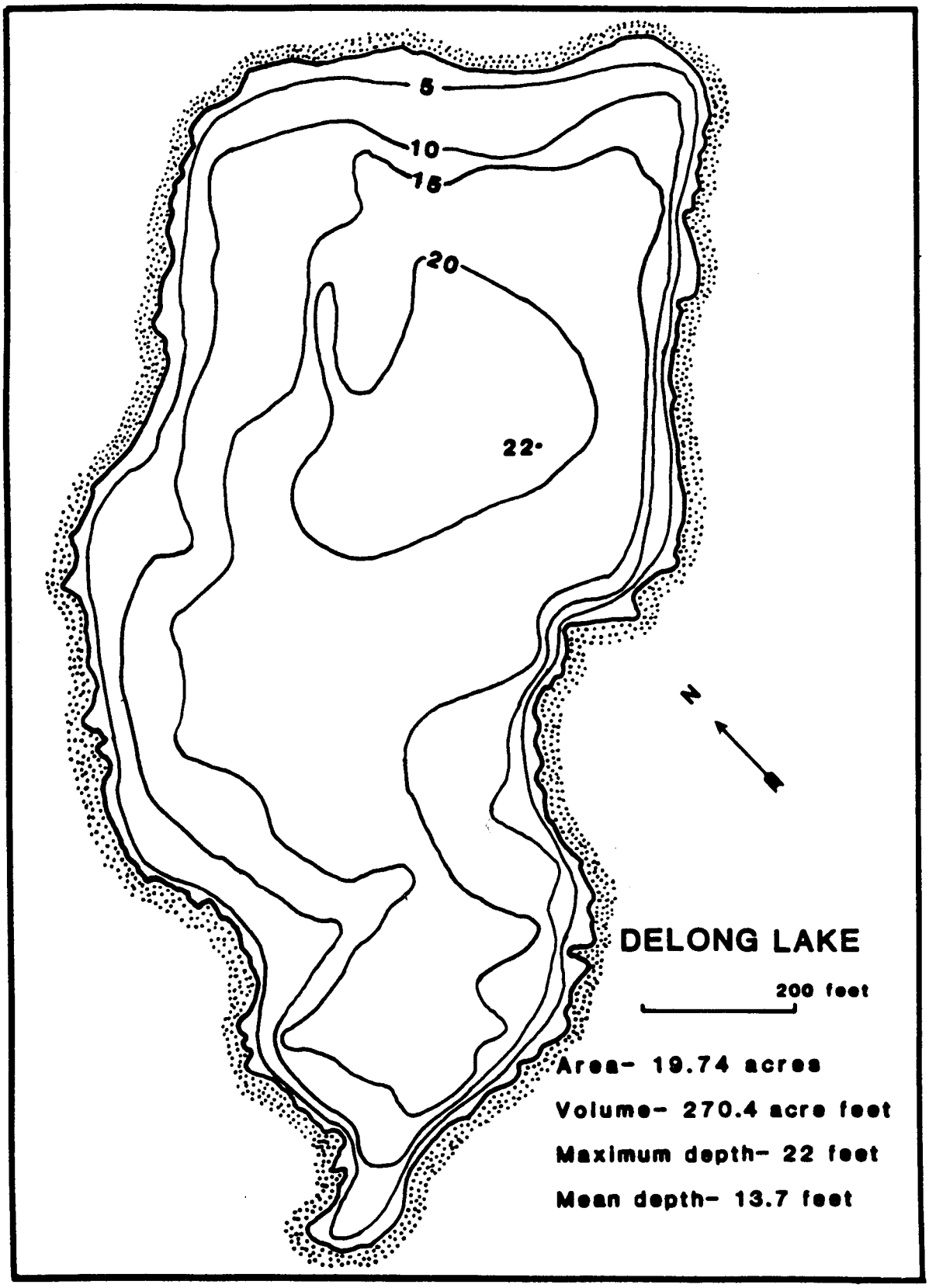

Figure 2. Bathymetric Map for Delong Lake, 1985.

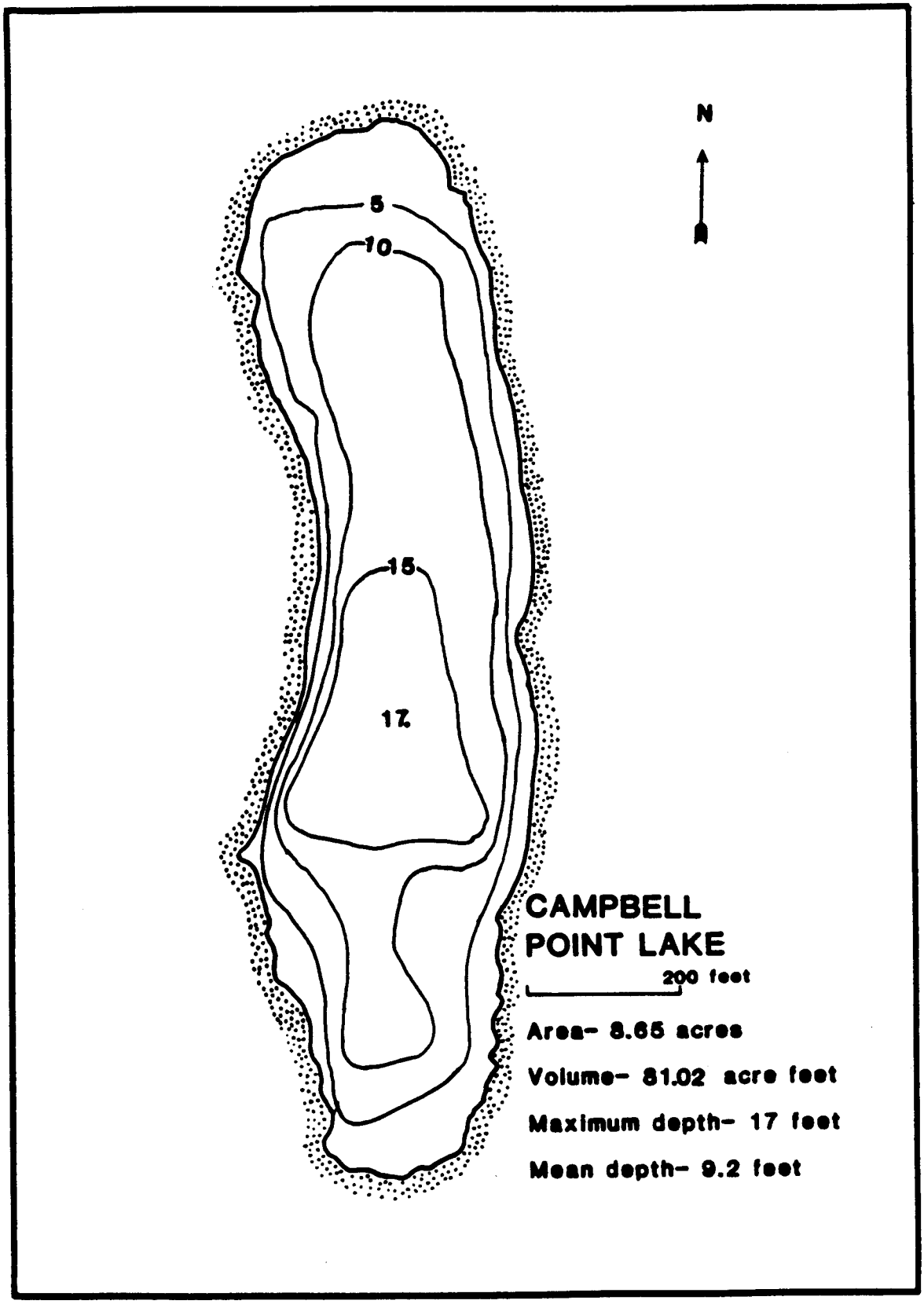

Figure 3. Bathymetric Map for Campbell Point Lake, 1985.

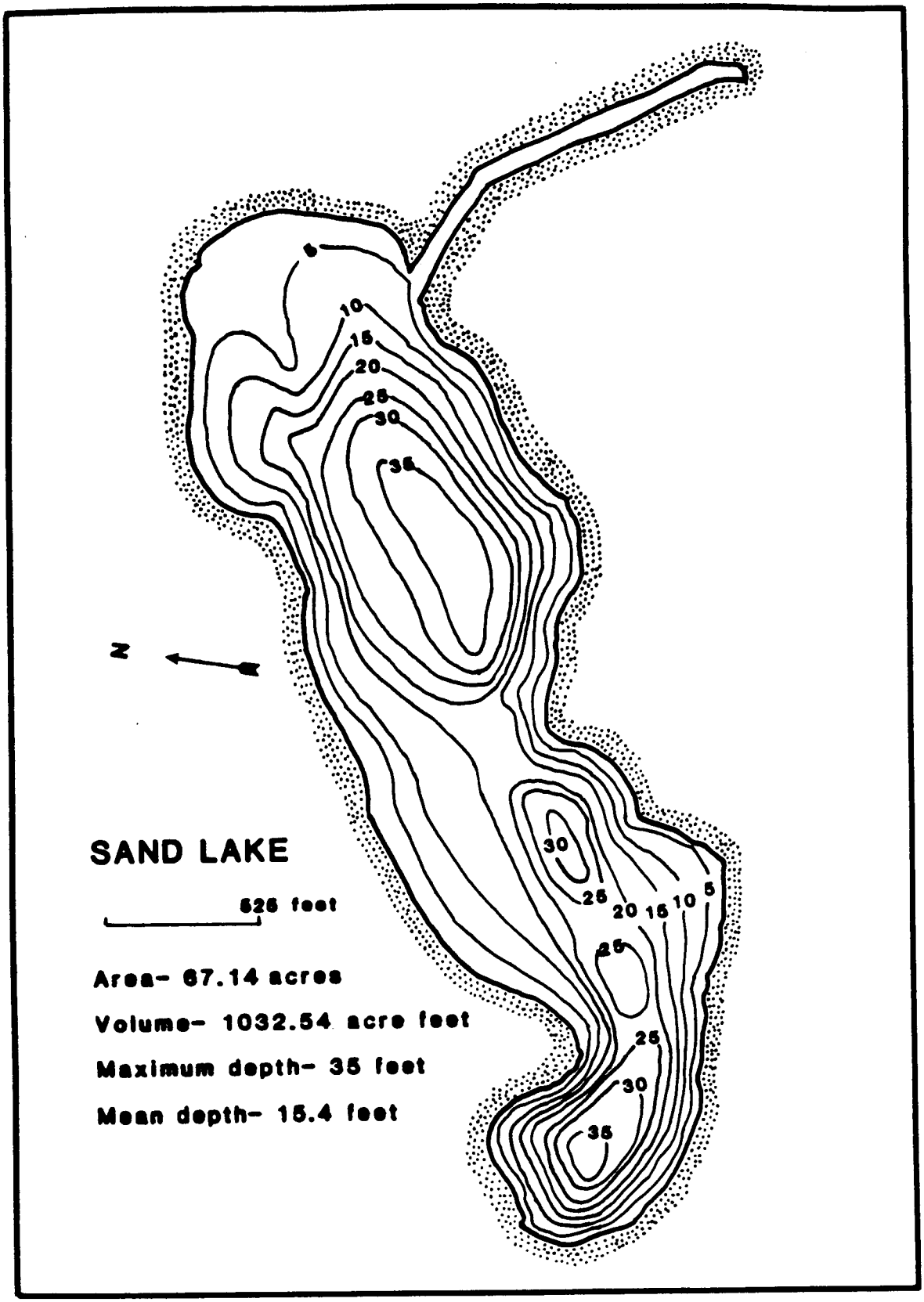

Figure 4. Bathymetric Map for Sand Lake, 1985.

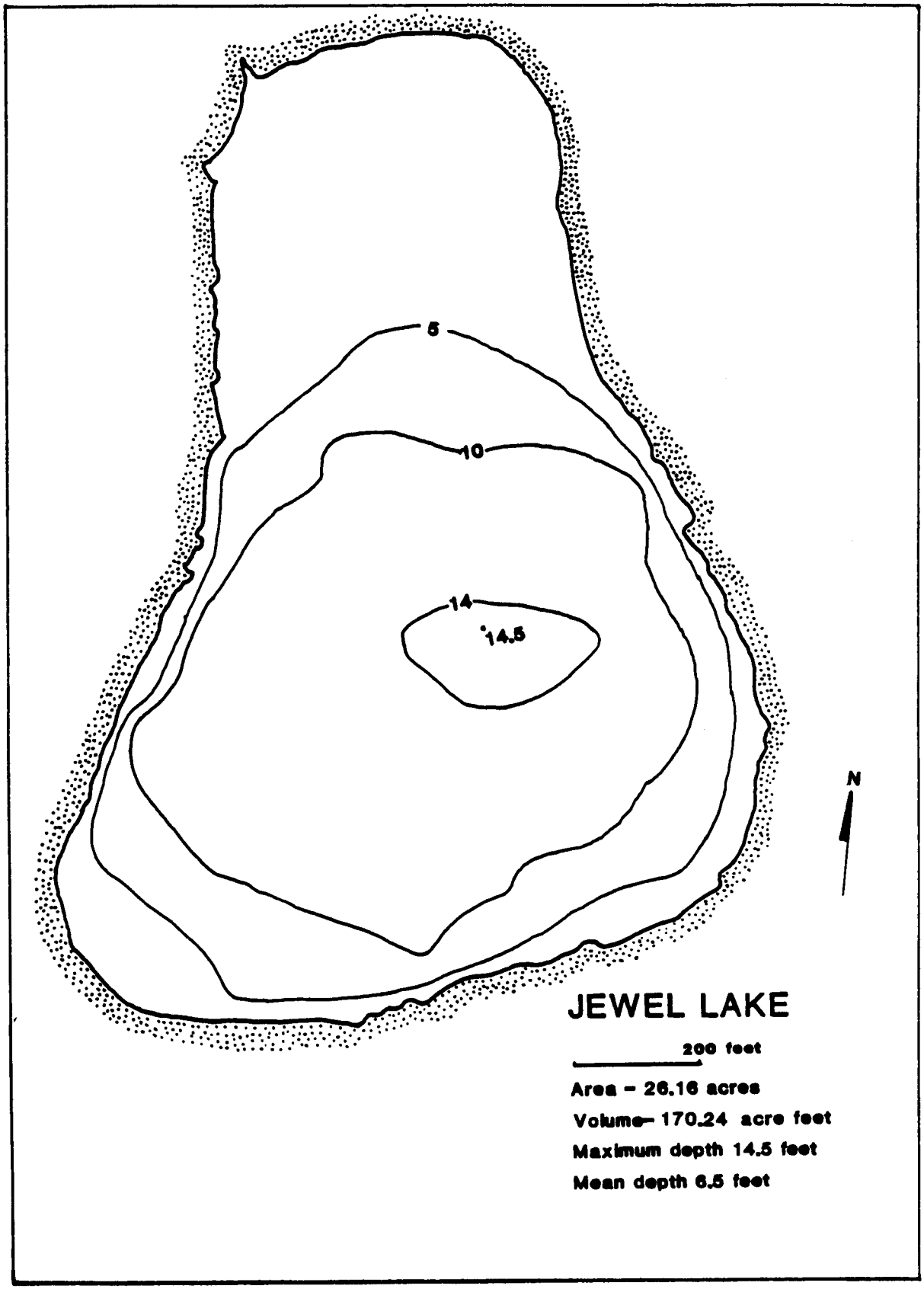

Figure 5. Bathymetric Map for Jewel Lake, 1985.

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